REMARKS

In paragraph 3 of the Office action, the examiner states that the Information Disclosure Statement filed 10/20/2003 did not contain the required legible copy of each non-patent literature publication. In response, a copy of form PTO/SB/08B and copies of the two publications listed on that form are filed herewith.

In paragraph 4 of the Office action, the examiner states that serial numbers and dates are missing from paragraph [0044] of the specification as filed. Appropriate amendments have been made to paragraph [0044].

Double Patenting

In paragraph 6 of the Office action, claims 1-26 stand provisionally rejected on the grounds of nonstatutory, obviousness-type, double patenting as being unpatentable over claims 1- 9 and 12-20 of copending Application No. 10/689,336. In paragraph 7 of the Office action, claims 1-26 stand provisionally rejected on the grounds of nonstatutory, obviousness-type, double patenting as being unpatentable over claims 1-9 and 11-20 of copending Application No. 10/689,312. In paragraph 8 of the Office action, claims 1-26 stand provisionally rejected on the grounds of nonstatutory, obviousness-type, double patenting as being unpatentable over claims 1-9 and 12-21 of copending Application No. 10/689,355. In each case, the examiner notes that in each of the cited copending applications, the processing elements are arranged in a loop while in the instant application the processing elements are arranged in a line. In addition to that structural difference, the independent claims of the instant application have been amended to recite that the first local cumulative deviation is determined by summing the local deviations associated "with upstream processing elements." Such a step is not possible with processing elements arranged in a loop. Furthermore, summing the local deviations associated "with upstream processing elements" is not a limitation that would be obvious in view of processing elements arranged in a loop. Thus, all of the nonstatutory, obviousness-type, double patenting rejections should be withdrawn.

35 U.S.C. § 101

In paragraphs 9 and 10 of the Office action, claim 26 stands rejected under 35 U.S.C. § 101 for reciting "a memory device." In response, claim 26 has been amended to recite "a computer readable memory device." Claims to a "computer readable medium" are authorized in the Interim Guidelines for Subject Matter Eligibility, in the section dealing with "practical application." It is believed that claim 26, as amended, is in compliance with the interim guidelines such that the 35 U.S.C. § 101 rejection should be withdrawn.

35 U.S.C. § 112

In paragraph 12 of the Office action, claims 1-26 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In paragraph ai, the examiner states that in claims 1, 16, and 26 "calculating a local mean number of tasks within each of said plurality of processing elements" is unclear. Applicant respectfully disagrees. The claims are read in light of the specification, and the specification discloses at least one method of calculating a local mean. See the published application beginning with paragraph [0045]. Applicant asserts that one of ordinary skill in the art would know how to calculate a local mean based on the disclosure in the specification. Applicant should not be required to write a preferred embodiment into the claims.

In paragraph ai, the examiner next states that in line 11 it is unclear whether the local deviation determining step is performed based on the preceding step. Claims 1 and 26 have been amended to make it clear that the local deviation is calculated from the local mean number. See paragraph [0052] of the published application. Claim 16 does not contain the same language.

In paragraph aii, it is the examiner's position that it is unclear what is meant by the "*V*" in claims 5 and 18. Each of claims 5 and 18 has been amended to recite that "*V*" is the total number of tasks. The examiner also indicates, with respect to "E_r", that it is unclear how that value is determined for each of the plurality of processing elements. The examiner's attention is respectfully directed to paragraph [0048] of the published application which provides:

> The rounding function $M_r = Trunc((V + E_r) / N)$ prevents tasks from being lost or gained. In the current embodiment, each PE is assigned a different E_r value for controlling the rounding. The simplest form for the function E is the case in which $E_r = P_r$ the number of the PE. For example, for PE_0, $E_0 = 0$; for PE_1, $E_1 = 1$; for PE_2, $E_2 = 2$;

> etc. By assigning each PE 30 a different E_r value, the rounding function can be controlled such that some of the local means are rounded up and some of the local means are rounded down, thus insuring that $V = \sum_{i=0}^{i=N-1} M_i$. It should be noted that in the current embodiment, the local mean for each PE 30 in line 50 is computed in parallel with the local means of the other PEs in the line 50.

It is submitted that reading claims 5 and 18 in view of the disclosure of paragraph [0048], one of ordinary skill in the art would understand how the value E_r is derived for each of the plurality of processing elements. With respect to claim 14, a definition has been provided for PE_r.

In paragraph aii, the examiner states that claims 5 and 18 recite PE_r without providing a definition. Claim 1, the base claim for claim 5, has been amended to provide the necessary definition. With respect to claim 18, the necessary definition can be found in claim 16, which is the base claim for claim 18.

In paragraph aiii, the examiner indicates that it is unclear in claims 7 and 20 how E_r "controls" the *Trunc* function. The language of claim 7 and claim 20 has been amended to recite that the *Trunc* function is responsive to the value of E_r. With respect to the examiner's question about how this step is possible, "since each E_r value is set ahead of time and must be different for each processing element," the examiner's attention is respectfully directed to paragraph [0048] reproduced above.

With respect to paragraph aiv, the examiner states that the recitation of "X and (X+1)" in claims 8 and 21 is unclear. The examiner's attention is respectfully directed to paragraph [0014] of the published application which provides as follows:

> The present invention enables tasks to be distributed along a group of serially connected PEs so that each PE typically has X number of tasks or (X+1) number of tasks to perform in the next phase. The present invention may be performed using the hardware and software (i.e., the local processing capability) of each PE within the array. Those advantages and benefits, and others, will become apparent from description of the invention below.

The examiner's attention is also directed to the table appearing in paragraph [0050] of the published application which provides:

PE_r	E_r	$(V+E_r)/N$	$M_r = Trunc((V+E_r)/N)$
PE_0	0	5.375	5
PE_1	1	5.5	5
PE_2	2	5.625	5
PE_3	3	5.75	5
PE_4	4	5.875	5
PE_5	5	6	6
PE_6	6	6.125	6
PE_7	7	6.25	6

Table #1 – Local Mean Calculation For $V = 43$, $N = 8$.

The language of claims 8 and 21 has been amended to indicate that a local mean for each group is equal to either X, or X+1, as seen clearly from Table No. 1 where X = 5 and X+1 = 6.

A definition for E_r can be found in claim 5, from which claim 8 depends. Claim 21 has been amended to depend from claim 18, which contains a definition for E_r.

In view of the foregoing, it is respectfully requested that the rejection of claims 1-26 under 35 U.S.C. § 112, second paragraph, be withdrawn.

35 U.S.C. § 103

In paragraph 14 of the Office action, claims 1, 2, 4, 9-17, and 22-26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over "A Simple Load Balancing Scheme for Task Allocation in Parallel Machines" (Rudolph) in view of Smith (U.S. Pub. No. 2004/0024874). Applicant respectfully traverses that rejection.

It is the examiner's position that the primary reference to Rudolph discloses "redistributing tasks among said plurality of processing elements in response to said first local cumulative deviation and said second local cumulative deviation." The examiner cites page 3, column 1, figure 1, and column 1, lines 19-22. While it is true that Rudolph teaches redistribution of tasks between processors, the redistribution is not responsive to the first and second local cumulative deviations. This is made clear in Rudolph, second full paragraph on page 4 which recites:

> The load-balancing task simply chooses some other PE at random and tries to equalize the load between the two workpiles (see Figure 2). If the difference in load between the two workpiles is greater than some lower limit, tasks are then migrated from the heavier loaded workpile to the lighter one. If the other workpile is currently being accessed, then either the PE may give up or else wait until the workpile becomes free. Our implementations suggest that there is little difference between these strategies. (Emphasis added.)

In addition to not teaching the redistribution of tasks in response to the first and second cumulative deviations, the Office admits that Rudolph does not disclose "determining a first local cumulative deviation for each of said plurality of processing elements" and "determining a second local cumulative deviation for each of said plurality of processing elements." The examiner relies upon Smith for those missing teachings.

Smith does not determine first and second local cumulative deviations as asserted by the examiner. Smith merely compares the workloads of pairs of processors, and the processor having the lower level of work simply requests work from the processor having a higher level of work. The paragraph cited by the examiner on page 2, paragraph [0027], confirms that understanding.

> With a bi-directional link between the first and second processor, both processors in a pair inform each other of workload and request work as appropriate. There is no requirement for such pairs to be arranged in a circle.

There is no determination of first and second local cumulative deviations in Smith. This is made even clearer in Smith, paragraph [0038], which recites:

> Referring firstly to FIG. 1, a closed loop 10 of processors 11 are connected by link means 12. Preferably the link means comprises connection though an electrical circuit or a packet switched network. The link means provide the means for comparison of workload and passing of workload between processors. In FIG. 1 the link means 10 are uni-directional, wherein the transfer of workload through the link means is in one direction. With a uni-directional link from processor A 13 ("upstream") to processor B 14 ("downstream"), A informs B of how much workload it has, B then compares this with its own level of workload, and if B is less loaded than A, then it requests work from A. It is therefore ensured that B has at least as much work as A. Such pairs are linked end to end in a chain, with all the links going in the same direction, with the ends of the chain joined together. This forms a closed loop with all the workload transfers travelling in the same direction. Since in each pair the one downstream of the link has at least as much

> work as the one upstream, and every processor in every pair downstream of another processor, it ensures that the entire ring is inherently balanced.

Therefore, contrary to the examiner's assertion, Smith does not provide the missing teachings. Furthermore, because the primary reference to Rudolph performs redistribution based on random selection of another processing element with which to compare workloads, and in the secondary reference to Smith redistribution is based on relative workloads of paired processing elements, it would not have been obvious to calculate first and second cumulative deviations and base the redistribution on the cumulative deviations. Thus, it is respectfully submitted that claim 1 is patentable, and the 35 U.S.C. § 103 rejection should be withdrawn.

With respect to claim 9, the examiner states that "(page 4 col 1 lines 19-22) finding the difference with the lowest limit (average) is calculating the deviation." The problem with the examiner's position is that Rudolph does not call his lower limit "an average". Rudolph merely refers to "some lower limit." The examiner, through the use of hindsight, characterizes the lower limit as an "average." When the hindsight reading of this section of Rudolph is removed, it is clear that this section of Rudolph does not disclose the subject matter of dependent claim 9.

The subject matter of dependent claim 10 has been added to claim 1. It is the examiner's position that the subject matter of claim 10 can be found in Smith, paragraph [0038], lines 4-12. Paragraph [0038] is quoted in full above. It is seen from paragraph [0038] that the processing elements are configured in a loop. This paragraph does not disclose summing local deviations associated with upstream processing elements. Indeed, this paragraph highlights how different the redistribution of tasks in Smith is from the claimed invention. Smith compares the workloads of pairs of processors, and the processor having the lower level of work requests work from the processor having a higher level of work. There is no calculation of a local deviation from a local mean number by finding the difference between a local number of tasks and a local mean number of tasks because that is not a parameter used to redistribute tasks.

The other two independent claims in the case, claims 16 and 26, stand rejected under the same rationale as the rationale for the rejection of claim 1. It is believed that the rejection of claim 1 on a basis of a combination of Rudolph and Smith has been overcome. Although both Rudolph and Smith result in the redistribution of workloads, both operate on a fundamentally different principle. Rudolph operates by comparison of workloads of randomly chosen

processing elements. Smith operates by equalizing the workloads between pairs of processing elements. Neither of the references operates according to the methodology set forth in claims 1, 16, and 26. Accordingly, it is applicant's position that all of the independent claims are in condition for allowance.

The remainder of the dependent claims not specifically argued in this amendment contain all of the limitations recited in their base claims. Because all of the base claims are believed to be in condition for allowance, all of the remaining dependent claims are also believed to be in condition for allowance. Applicant reserves the right to argue the patentability of the dependent claims separately, at a later date, should that become necessary.

Request for Interview

Applicant has made a diligent effort to place the instant application in condition for allowance. If the examiner is of the opinion that the instant amendment does not place the currently pending claims in condition for allowance with respect to the art of record, the examiner is respectfully requested to contact applicant's attorney at the telephone number listed below **so that an interview may be scheduled before the issuance of a final Office action rejecting the claims on the basis of the art currently of record**.

Furthermore, the amendment to claim 1 incorporates the subject matter of cancelled claim 10, and the amendment to claim 16 incorporates the subject matter of cancelled claim 22. As a result, the present amendment does not necessitate a new search and therefore cannot be the basis for a final Office action rejection based on a new ground of rejection.

Respectfully submitted,

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